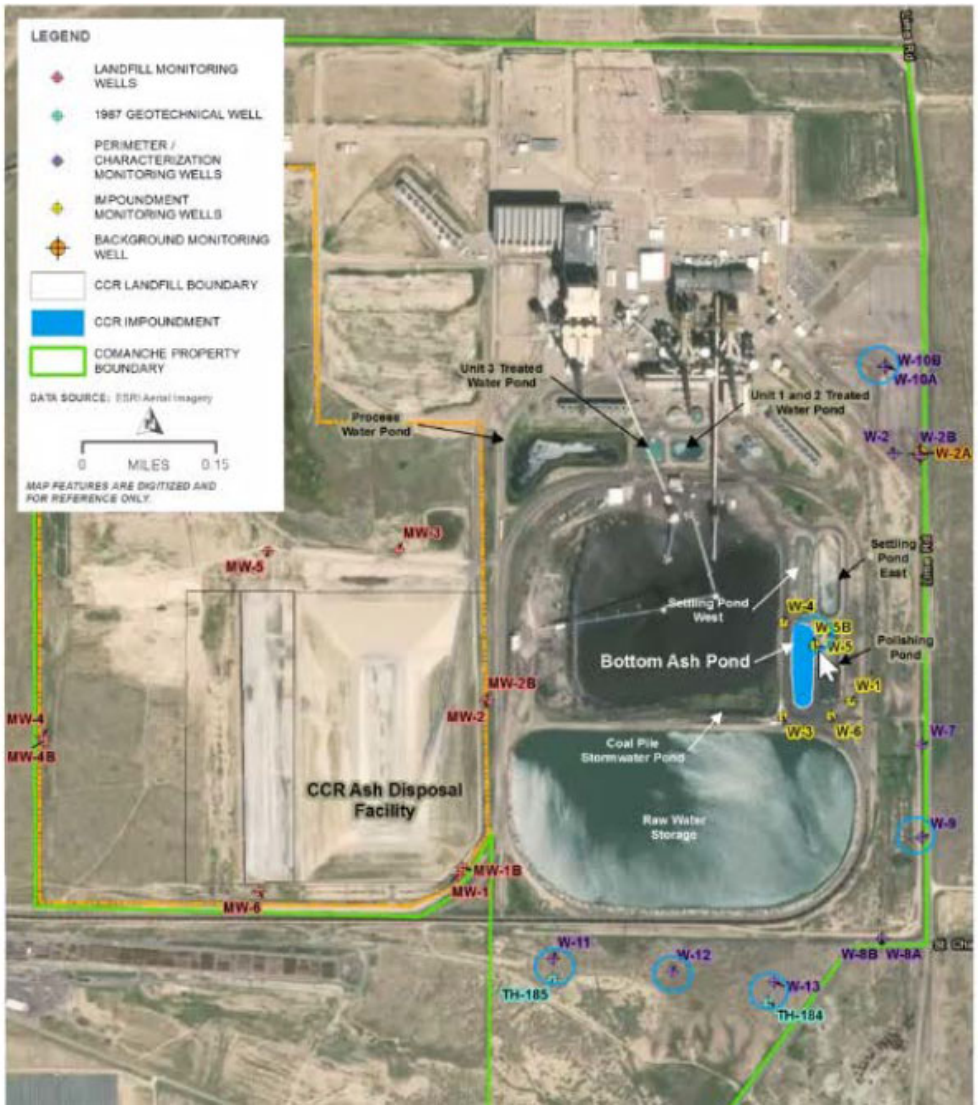
Comanche Station
Bottom Ash Treatment System Discussion
March 18-19, 2021


LEGEND
LANDFILL MONITORING WELLS
1987 GEOTECHNICAL WELL
PERIMETER / CHARACTERIZATION MONITORING WELLS
IMPOUNDMENT MONITORING WELLS
BACKGROUND MONITORING WELL
CCR LANDFILL BOUNDARY
CCR IMPOUNDMENT
COMANCHE PROPERTY BOUNDARY
DATA SOURCE: ESRI Aerial Imagery
0 MILES 0.15
MAP FEATURES ARE DIGITIZED AND FOR REFERENCE ONLY.
Unit 3 Treated Water Pond
Unit 1 and 2 Treated Water Pond
Process Water Pond
Settling Pond East
Settling Pond West
Bottom Ash Pond
Polishing Pond
Coal Pile Stormwater Pond
Raw Water Storage
CCR Ash Disposal Facility
W-10B
W-10A
W-2
W-2B
W-2A
W-4
W-5B
W-5
W-1
W-3
W-6
W-7
W-9
W-11
W-12
W-13
W-8B
W-8A
TH-185
TH-184
MW-3
MW-5
MW-2B
MW-2
MW-4
MW-4B
MW-1B
MW-1
MW-6

HDR, Inc.
8701 S Meridian Blvd, Suite 400
Englewood, CO 80112

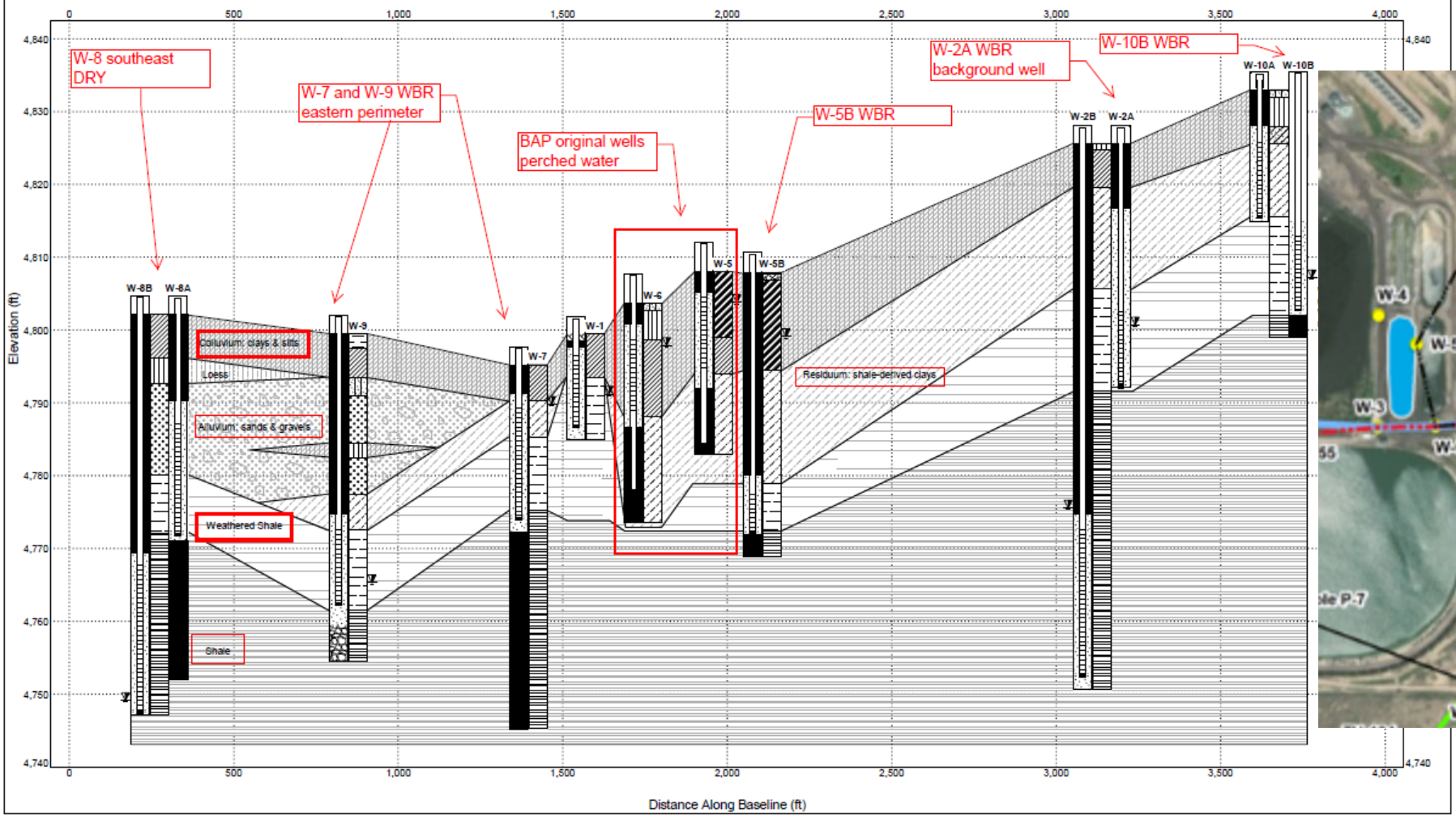
Preliminary

D --- D'
South - North

SUBSURFACE DIAGRAM

CLIENT Xcel Energy
PROJECT NUMBER 10217175
PROJECT NAME Comanche Station
PROJECT LOCATION Pueblo, CO

- USCS Low Plasticity Clay
- Residuum: shale-derived clays
- Asphalt
- USCS Well-graded Sand
- Weathered Shale
- Shale
- USCS Clayey Gravel
- USCS Low Plasticity Organic silt or clay
- USCS Silt
- USCS High Plasticity Clay
- USCS Silty Sand
- USCS Clayey Sand



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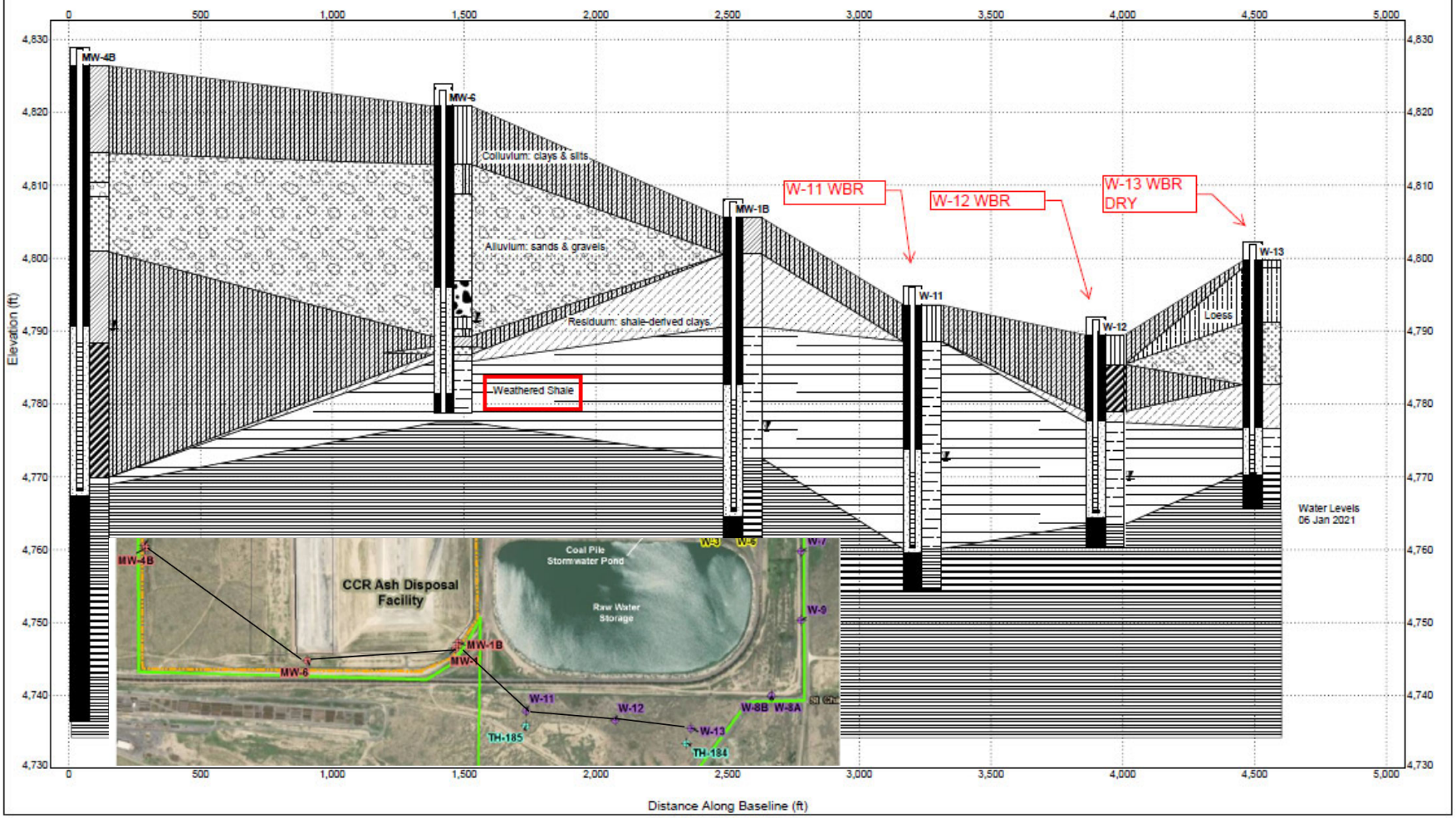
Preliminary

C --- C'
West - East

SUBSURFACE DIAGRAM

CLIENT Xcel Energy
PROJECT NUMBER 10217175
PROJECT NAME Comanche Station
PROJECT LOCATION Pueblo, CO

- USCS Low Plasticity Clay
- Shale
- USCS High Plasticity Clay
- USCS Well-graded Gravel
- Residuum: shale-derived clays
- USCS Well-graded Sand
- USCS Silt
- USCS Well-graded Sand with Silt
- Weathered Shale
- USCS Poorly-graded Gravel
- USCS Poorly-graded Sand with Silt
- Aeolian silt



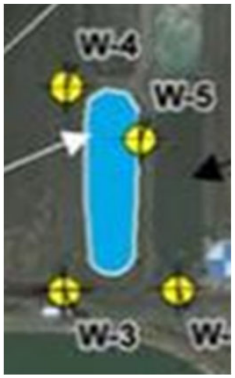
Groundwater Monitoring Issues/Questions

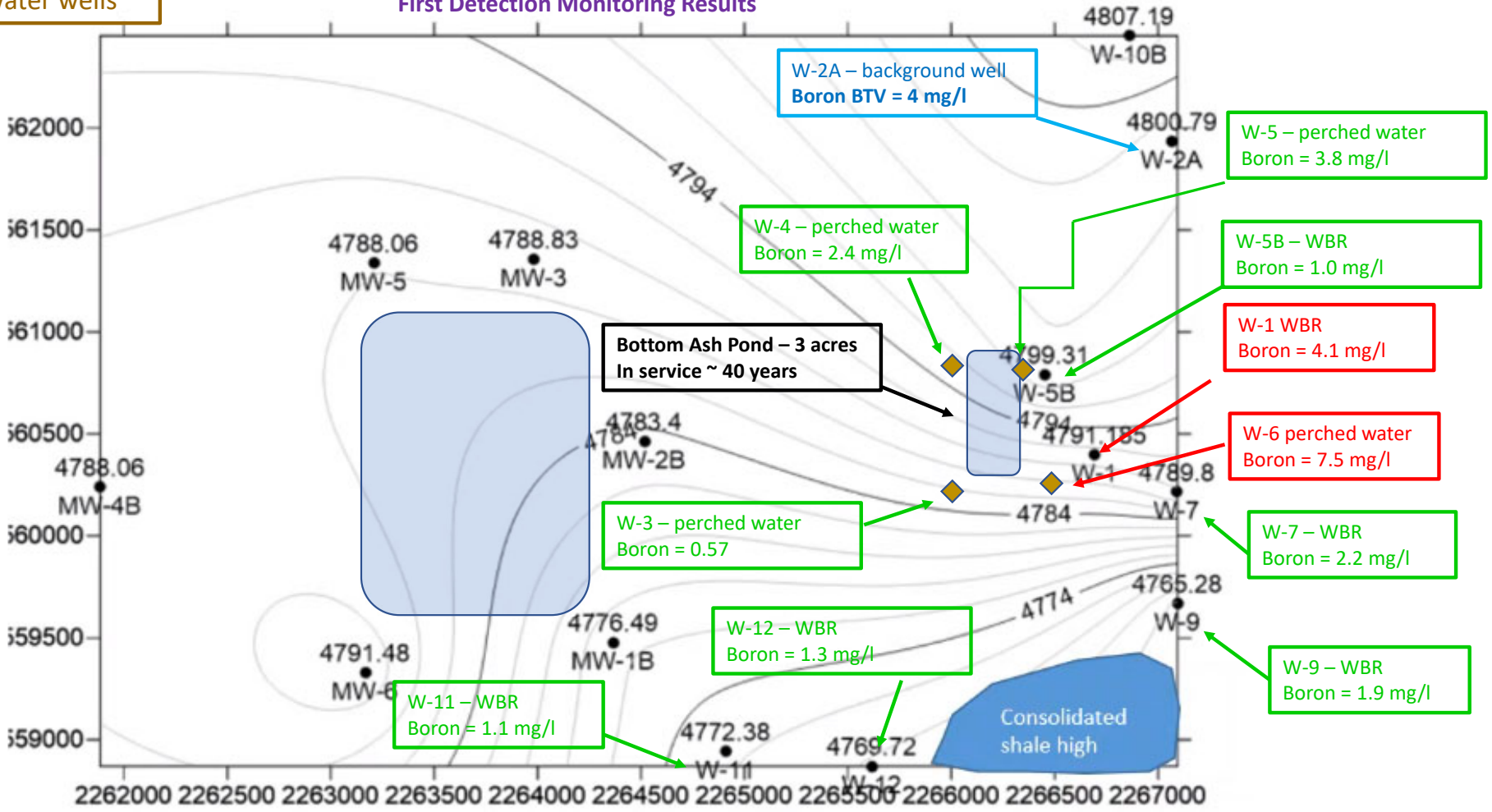
- Updated table and/or plots with all data collected to date
  - Export from database available
  - More user-friendly table in progress
- Has a statistical method been identified for SSIs?
  - Yes – Upper Prediction Limit (UPL)
- BTVs established and/or SSI evaluation completed?
  - Bottom ash pond
    - W-2A background well BTVs calculated
    - SSI for boron in two shallow adjacent colluvial wells
    - No boron SSIs in downgradient/property boundary wells
    - pH SSIs in multiple wells; parameter not unique to bottom ash
  - Landfill
    - MW-3 and MW-5 background data pooled, BTVs calculated
    - No SSIs in downgradient wells
    - 2 SSIs in cross-gradient wells completed in different geologic unit
- Assessment monitoring – 1st early April, 2nd mid-May

Perched water wells

January 2021 GW contours, weathered bedrock wells only

First Detection Monitoring Results





Upper Prediction Limits for Detection Monitoring for each Appendix III Constituent in Comanche Pond

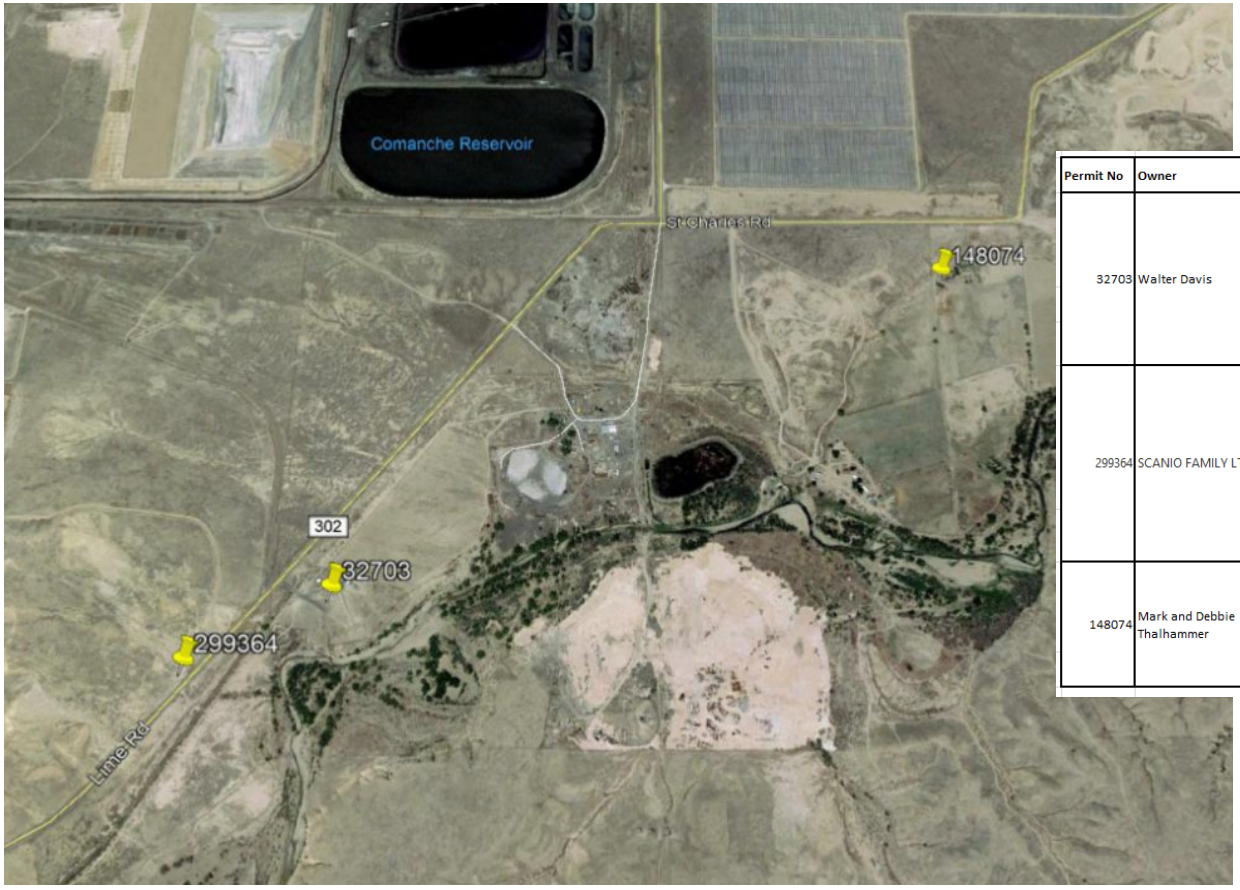
W-2A as background Well

Type	Constituent	Unit	n	BTV[4]	January 12-14, 2021 DM Sample Event									
					W-3	W-5	W-5B	W-6	W-4	W-1	W-7	W-9	W-11	W-12
Appendix II	Boron	mg/l	8	4.00	0.57	3.8	1	7.5	2.4	4.1	2.2	1.9	1.1	1.3
Appendix II	Calcium	mg/l	8	657	300	200	480	210	420	420	440	380	370	160
Appendix II	Chloride (a	mg/l	8	897	23	560	110	180	480	760	770	360	350	870
Appendix II	Fluoride	mg/l	8	578	0.68	<0.5	<0.5	1.7	4.4	3.1	<0.5	<0.5	2.7	<0.5
Appendix II	pH (field) (l	su	8	6.22	7.74	7.26	7.07	7.36	7.68	7.37	6.61	6.87	6.89	6.83
Appendix II	pH (field) (l	su	8	6.73	7.74	7.26	7.07	7.36	7.68	7.37	6.61	6.87	6.89	6.83
Appendix II	Sulfate (as	mg/l	8	86,791	1300	13000	3600	4800	29000	29000	48000	11000	14000	16000
Appendix II	Total Disso	mg/l	8	202,620	2000	16000	5300	6200	NA	42000	69000	16000	20000	23000

Upper Prediction Limits for Detection Monitoring for each Appendix III Constituent in Comanche Pond (based on background wells MW-3 and MW-5)

Constituent	Unit	n	No. Below MDL	% Below MDL	ProUCL's Best Fit [2]	HDR's Recommendations			Notes	January 12-14, 2021 DM Sample Event							
						Per-Test FPR (α)[3]	No. of Verification Samples	BTV[4]		MW-1B	MW-2B	MW-3	MW-4B	MW-5	MW-6	W-11	W-12
Boron	mg/l	18	0	0%	val; Normal	0.0016	0	6.65		1.5	2.1	2.2	0.49	1.3	2.1	1.1	1.3
Calcium	mg/l	18	0	0%	parametric	0.0001	2	470		120	150	160	510	210	430	370	160
Chloride (a	mg/l	18	0	0%	parametric	0.0001	2	1,800		410	580	360	200	1600	260	350	870
Fluoride	mg/l	18	5	28%	na; Normal	0.0016	0	444		1.8	1.3	<0.5	0.17	<0.5	0.25	2.7	<0.5
pH (field) (l	su	18	0	0%	val; Normal	0.0016	0	6.32	(*)	6.77	6.81	6.94	6.82	6.9	7.42	6.89	6.83
pH (field) (l	su	18	0	0%	val; Normal	0.0016	0	7.35	(*)	6.77	6.81	6.94	6.82	6.9	7.42	6.89	6.83
Sulfate (as	mg/l	18	0	0%	parametric	0.0001	2	42,000		19000	37000	36000	3000	18000	4200	14000	16000
Total Disso	mg/l	18	0	0%	Lognormal	0.0016	0	200,778		25000	44000	51000	5900	24000	6100	20000	23000

Plan/schedule to locate and sample downgradient domestic wells



Permit No	Owner	Sect	QtrQtr	Type	Yield (gpm)	Year	Total Depth	Perforated	Lith above Screen	Lith in Screen	Depth to water
32703	Walter Davis	29	SESW	Domestic	15	1967	72	47-72	0-53 clay;	**53-68 rocks and boulders;**	46
										68-70 blue clay;	
										70-75 blue shale	
299364	SCANIO FAMILY LTD	29	W1/2	Domestic	15	2015	**Alluvial** 7	26-46	0-26 earth and	**26-46 sand and gravel** (large rock);	38
										42-46 blue shale	
148074	Mark and Debbie Thalhammer	28	NENW	Domestic	15	1987	34	24-34	0-20 yellow cl	**20-30 Sand and Gravel;**	19
										30-34 Blue Shale	

Plans and timing regarding locating and sampling downgradient domestic wells

- Phased step out approach
  - CCR Rule and technically appropriate
- wells installed in 2020
  - 6 south and east of pond
  - 2 dry, 4 sampled
  - Limited impact in shallow colluvial groundwater adjacent to pond
  - Concentrations less than background in downgradient wells at property line
- Nature and extent is bounded
- Cross-sections from the CCR units to the St. Charles River (N-S)?

Impacts of continued use of pond?

- Anticipate no additional impacts to groundwater
- Pond is 3 acres and has been in service for over 40 years
- Impacts localized in two adjacent shallow wells in colluvium
- No boron SSIs further downgradient of the pond and at property line
- Additional weeks of operation would not exacerbate
- How/when would Xcel model this?
  - Results don't suggest it is needed
  - Recommend we continue to follow the steps of the CCR Rule
  - Mathematical hydrogeologic model would take considerable time

Tracking bottom ash quantities

- Bottom ash total ~ 30,000 tons/year
- Bunker
  - Ash slurry water contains <1% ash solids
  - Captures 75+% of total ash
  - Material is ~ DOT Class 6 road base
  - ~ 60-65% beneficially used, cement
  - 5 days/week; ~ 4 trucks/day
  - ~ 24,000 tons/year, good balance w/% solids in
- South ~ 1/3 pond area
  - Monthly
- North ~ 2/3 pond area
  - Annually
  - Mostly silt and vegetation
- Pond cleanout ~ 7,000 tons/year

Comanche Station Units 1 & 2 Bottom Ash Concrete Bunker
(front and side views)

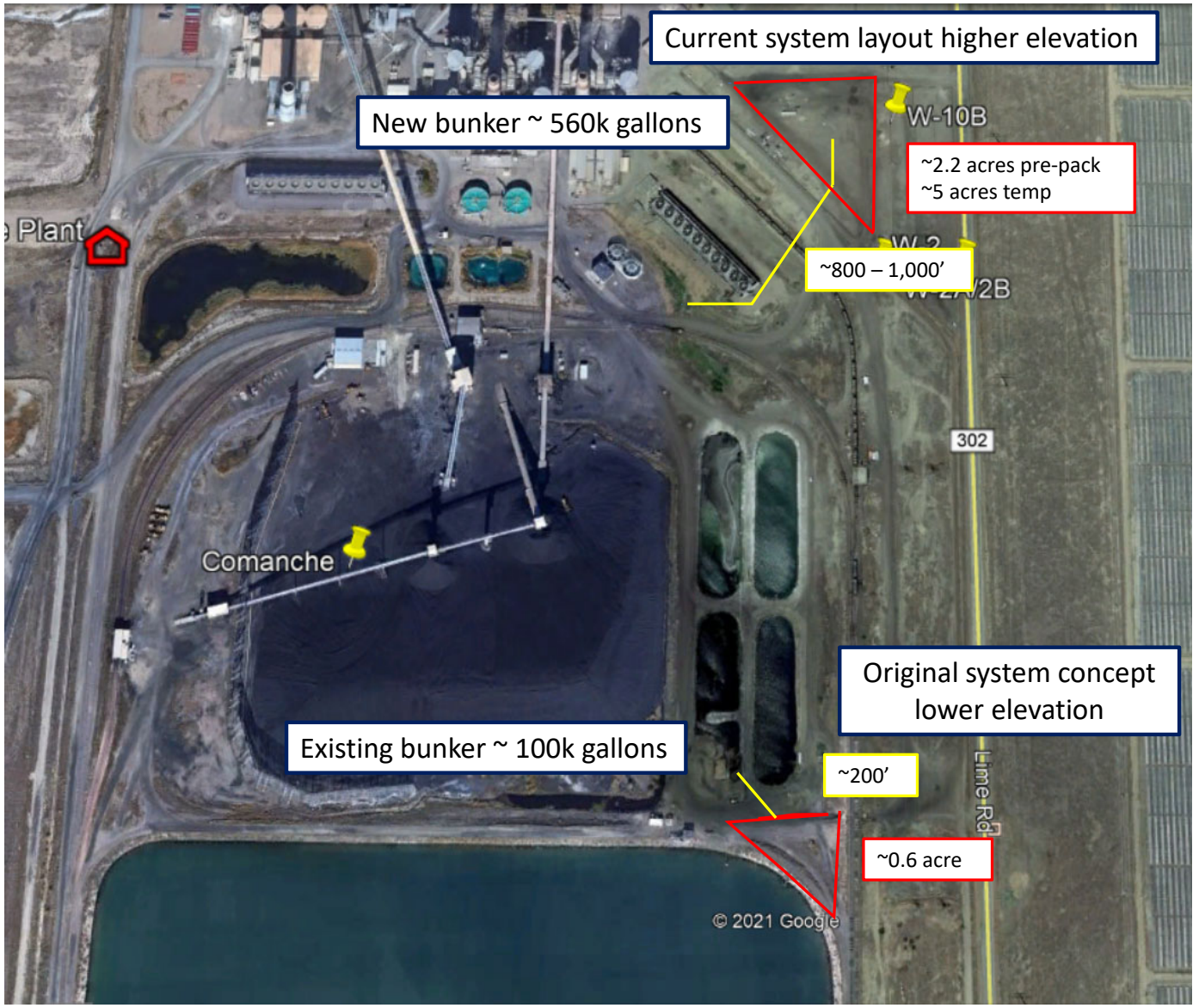
Groundwater Evaluation Summary

- First detection monitoring January 2021
- BTVs calculated as Upper Prediction Limit (UPL)
  - SSIs for boron in two shallow colluvial wells adjacent to pond
  - Impacts at pond localized; boron in downgradient wells less than BTV
  - No SSIs in down-gradient wells at landfill
- Nature and extent limited
- No additional impacts from pond anticipated
- Results support no potential impact to off-site wells

Bottom Ash Treatment System Update

Original System Design Concept

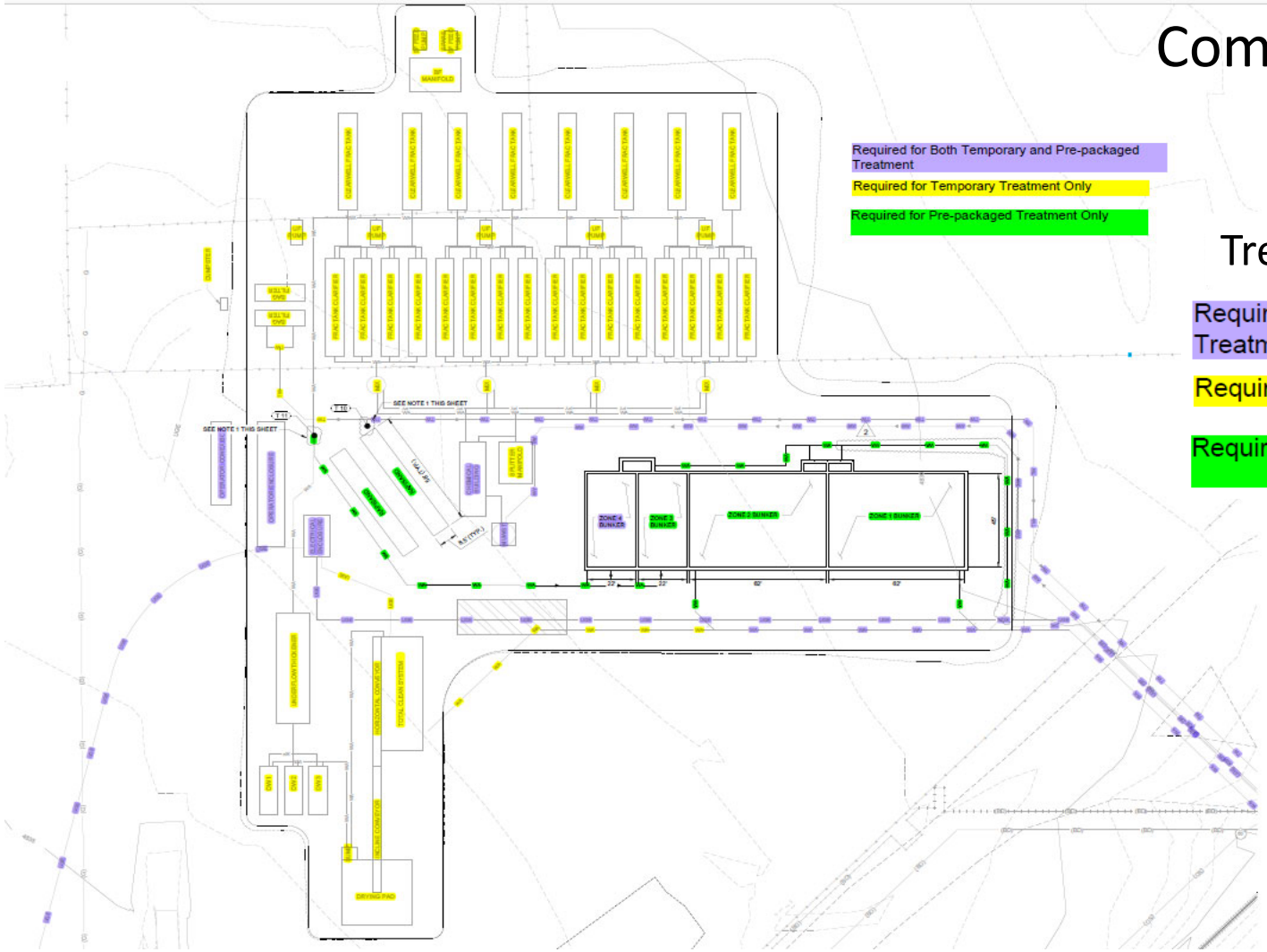
- September 25, 2020 EPA response
  - Parts A and B determined not viable
  - Very early design phase
  - Evaluating pre-packaged treatment systems
  - Initiated treatability study for system design and treatment specifications
  - Anticipated continued use of existing bunker
    - Bunker effluent to be routed to new treatment system
    - Bunker for flow equalization and bulk solids removal
    - Flocculant addition and clarifier tank to settle finer solids
  - Confirmed that the major system components were available
  - Schedule was ambitious, believed we could meet it based on info at that time
  - NPDES permit modification appeared to be longest lead time item


Current system layout higher elevation
New bunker ~ 560k gallons
W-10B
~2.2 acres pre-pack
~5 acres temp
~800 – 1,000’
Plant
302
Comanche
Original system concept
lower elevation
Existing bunker ~ 100k gallons
~200’
Lime Rd
~0.6 acre
© 2021 Google

System Design Progression

- 4th quarter 2020 design-build approach
  - Bid pre-packaged treatment system
    - Simple, reliable, performance guarantees, flocculant testing
    - Requires new significantly larger bunker for flow equalization
    - Larger footprint than original system concept; new site higher elevation
  - January 2021 temporary system needed to meet schedule
    - temp system not as 'elegant' as the pre-packaged system; numerous independent components connected to make a 'system'; non-automated
    - Larger footprint than pre-packaged system
    - January 31st ceased non-CCR flows 133 gpm continuous, ~ 200 gpm episodic
      - 2,000 gpm = total system flow rate; diverted non-CCR flows ~ 7%
  - Balance of plant
    - New larger bunker (~5 x existing bunker size)
    - Multiple borings under rail and water supply/return lines, electrical duct bank and local control center, chemical feed system, makeup water tank, thickener, dewatering tanks, high pressure feed pump in plant

Common components



Treatment Systems Layout

Required for Both Temporary and Pre-packaged Treatment

Required for Temporary Treatment Only

Required for Pre-packaged Treatment Only

Common System Components

- Bottom ash sluice water piping (~800’) to treatment location
- Treated effluent discharge piping (~1,000’) to the polishing pond
- Water supply piping (~1,000’) to the chemical feed building
  - 3 horizontal borings under rail crossing
- High pressure pump added in plant to address increased elevation
- Chemical feed building to mix and distribute coagulant and flocculent
- Zone 4 of bunker to transfer flow between treatment steps
- Electrical duct bank (~400 feet), to new centralized power distribution center to supply 1250 kVA

Temporary and pre-packaged systems status

- Temporary
  - Major equipment arriving this week
    - Total Clean tank, conveyors, 16 clarifiers, 8 clear wells, 2 bag filter trailers
    - Underflow thickener, dewatering tanks, chemical feed skids, buildings, piping
    - Weather delays – deliveries from Denver, site access conditions
  - Construction/installation
    - Excavations complete, bldg. foundations done, rebar/concrete in progress, zone 4 bunker floor pour next week, tank foundation ready for concrete,
    - Boring under rail complete; HDPE pipe welding on site in progress; install begins next week
    - High pressure pump in plant – to be installed
- Prepackaged
  - Major equipment on site mid-May
    - Operation date contingent on completion of bunker zones 1-3
    - 3 weeks to install, test, commission
    - Any float in schedule has been consumed


CAT

Schedule for conducting tie-ins

- Temp System - bunker zone 4 temp system – mid-late April
- Long lead items arrive mid-late May
  - Manufacturing backlog in all market sectors even for common items
  - Specialty valves, actuators, makeup water tank, control panel, pumps
  - Alternative materials, parts, sources to expedite schedule
- Temp System operational mid-June
- Bunker zones 1-3 pre-packaged system
  - Bunker all zones = 175’ x 45’ x 10’
  - Rebar, sequential concrete cure times, floor, walls
    - Heated enclosure, 3-day cure testing
  - Sealing, leak testing, backfill
- Bunker 1-3 concrete mid June
- Bunker 1-3 electrical early July
- Bunker 1-3 piping late July

Why Have Costs Increased?

- Pre-packaged system
  - September 2020
    - $885,000 - $1.2 million annual operating cost
    - Pre-design rough estimate
  - January 2021
    - $2.1 million annual operating cost ($4.2 for 24 months)
    - more detailed design, contractor bid
    - operating cost includes monthly system rental fees
    - increased labor to operate 24 x 7 x 365
    - 2-person crew on night shift, safety
- Temporary system for 90 days operation ~ $5 million
- Site prep (foundations, piping, bunker, etc.) costs = ~ $3 million

Possible Administrative Order on Consent

Does any entity other than Public Service Company of Colorado (PSCo)

- own Comanche Station units 1 and 2? No
- operate Comanche Station units 1 and 2? No
- own the bottom ash impoundment? No

Does any entity other than Public Service Company of Colorado operate the bottom ash impoundment?

- PSCo is the sole operator of bottom ash discharges from the plant to the pond
- PSCo is also the sole entity in control of when bottom ash discharges to the pond will cease
- A PSCo contractor maintains the pond by regularly removing bottom ash from the bunker/pond system

Discussion